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Dams and Development in the French Alps in the Inter-war Period

Anne Dalmasso

EDITOR'S NOTE

Translation: Brian Keogh

1 Are dams tools for development and, more importantly, for "sustainable development"? This question was central to work conducted by the World Commission on Dams, which published its report in 2000. The studies undertaken by the commission were largely dominated by the question of the impact of large dams in countries of the so-called "South" and were part of a review of the development policies implemented by major international agencies, and in particular the World Bank. But the studies also voiced criticism concerning the dams themselves, raising questions about the reality of their performance and their negative environmental and social impacts. The somewhat nuanced conclusions of the Commission[1] reaffirmed the positive role of dams while at the same time insisting on the reality of their negative impacts, impacts that had been ignored for too long. It was no surprise that those against dams saw a justification of their criticism, while those in favour saw encouragement to continue development work, once recommendations had been integrated in implementation policies. Dams are presented as a source of renewable energy and, subject to a change in the way dam worksites are organised and managed, are now put forward by their promoters as a tool for "sustainable development" just as they had been a tool for plain and simple "development" in the previous decades, which obviously critics of the dams take issue with.

2 Transposing these questions to the Alpine context may appear incongruous, as neither the time, the location or the scale of the developments is comparable. However, given the heated nature of the current debate, it seems surprising that opposition to large Alpine

dams has been limited, even though there has been some, namely in Switzerland. In France, the case of Tignes is most significant even if its interpretation has given rise to numerous misinterpretations (Bodon, 2002). It is true that although there are numerous large dams in the Alps, in the technical sense of the term[2], none is comparable to the large dams of South America, Africa, China or India with regard to their impact. However, underpinning current issues there are perennial questions and ideological justifications in terms of "modernisation" that exhibit certain similarities over time. Indeed, they raise fundamental questions such as who the land belongs to, who can legitimately decide on its use and the forms this use takes, and who owns the resources created by this use. They also raise questions of a spatial and temporal nature. First, is there a balance between resources and their uses in space (geographic, social and political) or, in other words, is there a balance between those who suffer a loss of land and those who reap the rewards? Second, is there a balance between resources and uses over time (do today's uses compromise those of tomorrow or, on the contrary, do they make them possible)?

3 In the Alps, the construction of large dams was spread over two main periods, the first in the 1920/30s and the second in the 1950/60s[3]. This paper focuses on the first phase of construction in the French Alps, by attempting to show how the question of impacts, both positive and negative, of large dams was presented by the different actors, firms, public authorities and local populations. The inter-war period was in fact a time of profound change in the French hydroelectric power system (Morsel, 1994). Until then, the electricity produced was largely used locally, and the areas of positive economic impacts, in terms of industrialisation and jobs, and those of negative impacts, in terms of land use, changes in the use of water, and industrial pollution, coincided. From the 1920s and the introduction of regional and then national electricity networks, the areas of positive and negative impacts gradually became geographically separated or disconnected. The first large dams, with a considerably greater impact than earlier power stations, were situated at the crossroads of these two systems and provide an opportunity to examine this key period in the history of alpine dams.

The Alps and hydraulics, a long history but recent dams

4 The history of hydraulics in the Alps stretches back a long way and is based on the methods used by man over the years to master the area's water resources, which although an asset also represent a danger. Whether it is for agriculture or small or large-scale industries, water is at the heart of "traditional" power and production systems in the sense that it preceded the generalisation of steam, then electricity. The density of structures on most rivers is striking, with modest installations that generally did not include large reservoirs. Operation depended on a run-of river system or hydro-peaking over a few hours using diversion canals or small basins. The levels of water used to provide power often fluctuated. With changing water levels or changing economic conditions, sites could be abandoned then started up again, moved or even reconverted, for example from a saw mill to a water mill, or from a forge to a weaving mill. Their activity was often intermittent, dependent on the irregularity of flow, with the power produced remaining at a modest level. These rudimentary installations corresponded to well-tested and relatively well-mastered techniques, producing levels of output that though mediocre were sufficient to meet user needs.

5 The transformation of this power production system took place in two stages. The first phase saw the modernisation of the hydro-mechanical techniques in the first half of the 19th century, thanks to development of the turbine and the mastering of the penstock technique, particularly high-head developments. This enabled the growth of the paper, cement, textile and even metallurgical industries (hydraulic rolling mills), using hydromechanical power, and the early development of equipment manufacturers. In the French Alps, the papermaking industry could be considered as being at the origin of hydroelectric power (Morsel and Parent, 1991). This traditional activity, based on a large number of small-scale units at the time of the rag paper industry, entered into a real industrial phase with the adoption of wood pulp from the second half of the 19th century. The increased needs for energy to power the rasps and defibering machines were satisfied by harnessing power from medium-head falls with large discharges (as at the Neyret paper plant in Rioupéroux, on the Romanche river) or from high-head falls (Aristide Bergès plant at Lancey and other paper-makers in the Grésivaudan valley). But apart from the question of power, there was also that of flow regulation and thus of dam construction.

6 The construction of dams is not something new. It is estimated that there were 35 large dams in France in 1900 (Bordes, 2005), but also thousands of small dams, many of which were several centuries old. Before 1850, dams were mostly built to supply shipping canals and had their technical origins in the more modest structures that were built to operate large iron works. Subsequently, large dams began to be built to supply water to towns, regulate flow, meet power requirements, and provide flood protection and sometimes irrigation in the Massif Central (Gouffre d'Enfer, 1866, 56m, upstream of St Etienne), the west of France and the midi region (Barrage Zola). The power component in all these development projects, however, was always important.

7 Dam construction in the Alps came later. The first hydraulic system functioned without dams and it was not until transformation of the hydraulic system in the 19th century that the need for regulation became important.

8 Among the first interesting projects were two launched by paper-makers to regulate the supply of water to power their plants: Armand Aubry at La Girotte from 1892 and Aristide Bergès at Lac Crozet from 1881. Operations involved drilling through the rock and raising the water level of natural lakes. In both cases, the idea was to improve the performance of high-head power plants by regulating flow, especially in winter. In both cases too, their operation gave rise to disputes with earlier users: these were not disputes over the principle of the development projects, but over the control of land and water rights. They thus became part of the long history of quarrels involving landowners and those living along rivers who are quick to take conflicts over water use to court in order to guarantee their rights and, in some cases, to obtain financial compensation. It was mainly to warn industries about this type of practice that the law of 1919[4] was passed, transferring to the State the decision to grant or refuse authorisations and concessions.

Changes in the electrical system and the first large dams in the Alps in the 1920s and 1930s

9 The development of hydro-electrical techniques from the 1880s radically changed the alpine hydraulic system and gave the region a temporary but decisive comparative

advantage in industry and particularly in the production of electrical energy. This "advantage" was the result of several factors: progress in mastering electricity production techniques, the combination of these techniques with modern hydraulic techniques, and the technical and economic limits of conditions governing energy transmission. It was also thanks to development of a new manufacturing process in the budding electrometallurgical and electrochemical industries which had substantial electricity requirements, particularly direct current (Varaschin 1996, Morsel, 1997).

10 Companies created to exploit these new opportunities chose to set up their plants close to alpine power plants, mainly between the 1880s and the beginning of the First World War, and this was decisive for the history of both industry and power production in these regions. In 1910, 57% of the 473 000 hydraulic horsepower surveyed in the Alps by the Hydraulic Power department (Service des Forces Hydrauliques) was to meet the needs of electrometallurgical and electrochemical production. In this first phase, hydroelectric power provided a direct and enormous stimulus to industry, transforming certain alpine valleys into industrial working class valleys: the Maurienne, the Tarentaise, the Romanche, parts of the Val d'Arly, the Chedde basin, and the southern section of the Argentière valley.

11 In the interwar-period, large industrial groups were formed that organised the alpine electrical system according to their increasing needs and to changes in the general electricity system. The latter had benefited from progress in energy transmission techniques, enabling first a regional then a national network of interconnections (Bouneau, 2007). Thanks to the construction of large dams, the Alps were no longer simply an area of local hydropower resources to be exploited locally, even though this aspect remained. They became a place with specific functions as part of a national network. The SECEM-AEU (Ugine) and Alais Froges and Camargue (Pechiney) completed the construction of vast hydroelectric complexes centred respectively on the Beaufortain and Maurienne[5] regions and connected them to regional electricity networks and then to the national grid as it became available. At the same time, the major power distribution and transmission companies began to take an interest in the Alps, a region that until then had supplied very little non-industrial demand, as a potential source of power to complement the thermal power plants in supplying the Paris region. The crisis of the 1930s accelerated this phenomenon in that domestic demand remained more dynamic than industrial demand.

12 The electricity market thus began to function as a national market, depriving the Alps of its hitherto special role as a power supplier, but at the same time opening up new prospects for the region. Apprehension about the place of the Alps in the energy strategies of businesses changed, and the impact of their development projects in the alpine region also increased considerably. The government (the Civil Engineering Department (Ponts et Chaussées) and particularly the Hydraulics Department) played an important role in these developments. Following a law passed in 1919, the government enjoyed increased power and exerted considerable influence on planning and development projects with a view to promoting the general exploitation of hydraulic resources in the general interest.

13 Construction of the first large dams in the Alps was part of this development process. Four large dams were built in the inter-war period: Le Sautet, Le Chambon and Bissorte, commissioned between 1934 and 1936, and La Girotte, built in two phases (1921/25 and 1941/49). The Bissorte dam, in the Maurienne valley, and La Girotte, in the Beaufortain

region, were major elements in the hydropower systems of the Pechiney and Ugine companies respectively. The Sautet and Chambon dams were built thanks to the grouping together of individual firms but where public financing played a decisive role. These dams provide good examples of the relationships that large dams developed during this period.

The Sautet dam

14 The Sautet dam, completed in 1935, is a very good example of the changing role of hydraulic resources in the inter-war years (Morsel, 1994). The dam's history is that of a slow and difficult construction that, for its time, was technically exceptional[6] (Dusaugey, 1943) and was at the heart of changes in the alpine energy system during the inter-war period. Until 1914, the Drac river was only equipped in its lower reaches (Avignonet in 1903, Champ sur Drac in 1901, Drac-Romanche in 1918/21). Numerous development projects had been studied for the upper reaches, but came to nothing. All these projects involved only modest structures a few metres high, since the need for reservoirs and generalised development of hydropower resources had not yet been felt. In 1918, a metallurgical company, la Société des Haut fourneaux de Chasse, submitted a request for a simple 4-metre high diversion dam on the site of the future Sautet dam. The government department of civil engineering (Ponts et Chaussés) refused it, requesting instead that a much more extensive project be studied. As in numerous other cases at this time, it was therefore the government that pushed for a larger dam with a view to making better use of water resources, adopting a more global vision of electricity needs compared with numerous individual companies that were only concerned with their own supplies. A consulting engineer commissioned to work on the project, Ernest Dusaugey, found that a little-known section of the Drac valley was particularly suitable for the construction of a large dam. He subsequently devoted the rest of his professional life to completing the project: 126m high dam for a reservoir of 100 million m3 supplying three power plants[7] for an estimated production of 400 million KWh. At first, however, the project seemed to have little chance of being completed because of lack of capital. Support from the government and senator Léon Perrier (chairman of Isère General Council and first chairman of the Compagnie Nationale du Rhone (CNR)) was decisive in obtaining public funding. Following an agreement in 1923, "recognising the considerable advantages offered by the use of a remarkable natural site from the point of view of both energy created as well as flow regulation on the Drac"[8], the government gave its financial backing to the new project. Later, in 1926, Pechiney took up the affair again in order to supply a plant that it planned to build downstream of Champagnier. But the crisis of the 1930s forced it to give up this idea and the project changed once again. Pechiney linked up with one of the large electricity production and distribution groups, the Union pour l'Industrie et l'Electricité, to ensure an market in the public distribution of electricity destined for the Paris region[9]. It can thus be seen how, with the changing interests of the different actors involved, the role of dams in the electricity generation system was gradually modified.

15 However, dams are not solely a question of techniques and economics. They mobilise the imagination and give rise to lyrical or sometimes demonizing discourse in which the authors transmit a little of their vision of the world. In this regard, the Sautet dam is most revealing. In 1943, the engineer Ernest Dusaugey[10], who discovered and promoted the site, wrote the history of what he considered as his "life's work", thus sharing, through

his description of the works and the dam's technical characteristics, his vision of one of the very first large dams in the French Alps. His text, written during the darkest hours of the Occupation, is a hymn to trust in the virtues of large dam techniques, providing tools with which to master Nature and create wealth for the good of all. In the midst of the "renunciations" of the 1920s and 1930s, "those disastrous years, (when) under the combined effect of social violence and demagogical laws, anaemia affected every organism of production (translation)", the construction of dams appeared to him like a "magnificent expression of the value of one technique that had not given up the fight (translation)".

16 His description of the development project followed a tried and tested discourse structure rooted in the positivist scientism of the end of the 19th century, in a version adapted to electricity in general and to "hydropower" in particular (Dalmasso, 2001). Using a series of clichés which tend to feed this type of literature, he begins by evoking untamed Nature, such as it was before the arrival of the engineer and the dam: "this is the face of the mountains, with their so diverse characteristics of grandeur and beauty, but also of austerity, melancholy and sometimes sadness: their majestic peaks of dazzling snowy whiteness, their jagged summits and blue glaciers (...) their picturesque villages clinging like nests to the valley sides; but also their lofty and harsh bare cliffs, arid plateaux and threatening, sterile landslides, (...) and, here and there, depopulated, deserted hamlets (translation)". Then came the discovery of the dam site by the engineer: "What is surprising is that nobody had ever thought of what could happen in this area entirely hidden by a bend in the river (...) We were more curious and had good reason to be so (...) it was not possible to imagine a place that was more suitable for building a large dam (translation)".

17 Then came the apparent surprise of the traveller upon discovering, in these remote places, the benefits of progress: "It is not without surprise that the traveller now finds himself suddenly in the presence of a magnificent expanse of water that, as far as the eye can see, masks the bottom of the valley and creates a landscape full of charm and novelty. This is the artificial Lake Sautet (translation)". With it arrived modernity and wealth: "Before, coarse and untamed Nature had reigned in this corner of Beaumont (...) Today, the place has given birth to a new site and a new life. Reliable access routes have now been established (...) the picturesque lake has attracted a substantial flow of tourists. Finally, the presence of an industrial plant has provided a hitherto industrial desert suffering from depopulation with an economic activity and resources unknown until then (translation)". This very stereotyped discourse is somewhat exaggerated (tourism remained very modest) and imprecise (the industrial activities that resulted from the dam were not in fact in this area). Its vocation is not so much one of description but rather of justification, the dam being seen as part of progress. From the start, the dam's impacts were therefore seen as positive. In the description, albeit meticulous, of the development project, it is impossible to find the least mention of any negative impact. All that is mentioned, right at the end of the document, is "sedimentation in the Champsaur upstream of the Sautet dam and, downstream, deepening of the bed of the Drac resulting from reworking of alluvial deposits by the sediment-free water". These phenomena are considered as "inevitable reactions from nature under attack (translation)." (Given that) The Sautet dam was built at a relatively isolated site and no dwellings were lost when the reservoir was flooded[11], so that it did indeed have a limited impact on surrounding communities. Dusaugey's enthusiasm for this "beautiful structure" was not therefore met

with opposition or counter arguments. In general, the same can also be said for the Chambon dam, even though the consequences for the local population were far more serious.

The Chambon dam, a well-negotiated (modest) flooding operation

18 The Chambon dam was built between 1928 and 1937 by a semi-public company founded by the Ministry of Public Works and a Romanche users' association (Morsel, 1994; Bauer, 1987; Obled, 1998). The latter was a group of industries which, from the end of the 19th century, had installed their hydropower plants and electrochemical and electrometallurgical industries in the lower valley. The dam was designed to regulate flow on the Romanche river and thus to facilitate the operation of existing power plants and provide additional electric power not only for local industries but also for industries in the Grésivaudan valley via a line across the Belledonne massif. The increased supply of electrical energy from the new plants exceeded local needs, however, and some was exported to national markets, as was the case for the Sautet dam.

19 The spatial link between the dam and its economic impacts, however, remained much more marked than in the case of the Sautet dam in that the plants situated in the lower valley, for which the development project had been designed, benefited directly. The spatial and social impact of the dam was far greater than in the case of the Sautet dam: the Chambon dam flooded a basin, the "plaine du Dauphin", which was inhabited and crossed by a well-used road leading to a mountain pass, the Col du Lautaret. It is true that the extent of population displacement may appear derisory compared with that caused by today's large dams: 3 hamlets, 200 people and a lavender distillery that attracted passing tourists. But at the scale of the Oisans region in the 1930s, it was certainly not negligible. The operation, however, seems to have been carried out smoothly: compensation payments were negotiated locally between local people. The company entrusted a former teacher and secretary at the Town Hall, chosen because of her integration in the local community, with the task of conducting negotiations. The amounts were considered as "correct". In addition, most of the expropriatees were able to resettle in the same municipality. There were therefore no conflicts, although there was some tough negotiating during which the company stood its ground about what it wanted. The local press reported on an "amazing human effort"[12]: "It is in the magnificent Oisans that we find this titanic dam. A few remnants of stone walls, a few lifeless houses with no smoke coming from the chimneys, it was in this desolate landscape that I happened to wander two years ago (...) Here, rugged men and brave women had lived, loved (...) the lake came... over these villages where the mountain winds blew can be heard the flight of those who disappeared (translation)". But for the most part, the discourse was about the area's tourist attractions, aimed at city dwellers, for whom tours were successfully organised. The Petit Dauphinois reported, for example, a visit of 250 war veterans: "Here is one of the marvels of the Dauphiné region of 1936. With its Babylonian proportions, it represents one of the finest, one of the most proud poems of concrete and masonry that has ever been raised to the glory of the technology of that time (translation)."[13]. A tour taking in the four mountain passes of Glandon, Croix de fer, Galibier and Lautaret could be made on a day's trip by coach from Grenoble and was further enhanced by a stop at the construction site and then the dam itself. In 1935, the

site hosted the Tour de France. The dam thus became part of the new vision of the mountains as an area that was both spectacular and recreational, an area developing in parallel with the growth of tourism. Apart from the question of fishing, which was carefully monitored by government departments as soon as the first hydropower installations were built, the negative impacts on the downstream flow of the Romanche were only considered and dealt with as they appeared, by awarding new compensation payments.

Conclusion

20 To come back to the questions raised by the dams concerning the methods of appropriation and land use, it should be stressed that hydroelectric power brought with it two major differences compared with the old hydraulic system, particularly after 1914: the need for impounding dams with their considerable spatial impact and the supply of energy produced in extensive regional and national (and later international) areas through electricity networks. The question of networks is vital in that it is the networks that separate the areas where social and environmental impacts are felt from those where the economic impacts are felt. It comes up again in the case of dams linked to major water supply and irrigation projects in that the areas from where water is taken are different from those where it is delivered. This separation only depends in part, however, on the spatial processes of technical and economic systems: it is based above all on the operation of the areas concerned and the relations between social and territorial identities at different scales: village, valley, region, nation, "world", which can be experienced as separate, contiguous or combined. It also depends on the reality of the economic and financial circuits that may or may not link the areas where resources are taken from and those where they are used, and that may or may not ensure a fair distribution of benefits and costs. The acceptability of dams thus depends largely on the way in which changes in the distribution of property rights and land uses are managed, and particularly on the ability to compensate gains and losses between the social groups concerned.

21 In the case in question, the discourse adopted by the French dam promoters in the inter-war period was aimed at showing that there was no break within a national territory that was developed for the benefit of a national community, that is for the benefit of all. This was generally approved by the populations concerned. Justification for dams in terms of their role in promoting development and modernisation was also generally accepted. The analyses conducted by Virginie Bodon for the post-war years for the dams at Tignes and Serre Ponçon may be applied in part to dams built from the 1930s onwards: the ideals of progress and modernisation relating to dams were shared by the local populations. Furthermore, they accepted or contested them depending on the modernising role that these developments appeared to them to guarantee. The interpretation of the situation at Tignes, an interpretation made at the time and often used since, as a defensive reaction of an archaic community rooted in its past, is thus largely false (Dolso, 1992). The first large dams thus found their place fairly easily in the alpine environment. It is true that their impact may appear limited compared with that of their successors but it was far from negligible and marked a clear change in scale in relation to earlier hydraulic development projects. It is also true that the bias of source material can result in the neglect of those reactions for which no trace was left. Disputes concerning financial compensation for

losses caused by dams or over the fixing of payments based on wealth produced were thus not always given their just weight by those seeking to the understand the reactions of "alpine social groups" to dams. However, in general it can be assumed that in the case of France, and at this period, there was fairly wide acceptance of dams because national integration was strong and many shared a widespread progressive ideology, even though there were some disputes over decision-making and compensation methods.

22 Underpinning the question of dams, there was thus a certain conception of "development" that was at stake in the 1930s as it was in the 1950/1960s and still is even today concerning the works of the World Commission on Dams, but at different scales: "The decision to build a large dam today is rarely only a local or national one. The debate has been transformed from a local process of assessing costs and benefits to one in which dams in general are the focus of a global debate about development strategies and choices" (World Commission on dams, 2000). The scale of development projects is being questioned, but also, more particularly, the changes in the perception of spaces related to the globalisation of environmental concerns that give a new global meaning to deleterious impacts (measured, for example, in terms of damage to world biodiversity or human rights in certain cases of population displacements) as well as to beneficial impacts (measured in terms of the growth of renewable energy or the struggle against global warming). The terms of arbitration are changing, but the stakes, concerning the development of relevant methods to assess benefits and costs and to impose equitable compromises, remain.

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NOTES

1. The 7 principal recommendations of the commission to make large dams acceptable are: gain public acceptance, assess all alternatives, optimise benefits from existing dams, sustain rivers and the livelihoods that depend on them, recognise entitlements and share benefits fairly, ensure compliance with regulations and standards, promote the sharing of all rivers for peace, development and security.

2. For the International Commission on Large Dams (ICOLD), a large dam is 15 metres or more high, or between 5 and 15 metres high with a reservoir volume of more than 3 million cubic metres.

3. There are some older dams (there were already 15 dams in the Swiss Alps before 1914) and some more recent, but these two phases account for the majority of dam development projects.

4. The law of 16 October 1919 states that the driving force of water belongs to the State and that "no-one can dispose of the energy of the tides, lakes and rivers without a concession or authorisation".

5. In 1946, electrochemical and electrometallurgical firms controlled 27% of national hydropower production and 45% of the storage capacity of large dam reservoirs.

6. Arch gravity dam of 126m, when the highest arch at the time was that on the Shoshone River (1910) in the United States (97.5m), now called Buffalo Bill dam.

7. Only one power plant, at the foot of the dam, was constructed in the first development phase, providing an average production of 155 MKWh. The power plant at Cordéac was built later and commissioned in 1947.

8. Dusaugey, 1943, p. 29.

9. Morsel, 1994, p. 71.

10. See Menegoz Jean-Claude, Nov. 1996, "Ernest Dusaugey (1871-1951), brillant précurseur en hydroélectricité", Lettre de l'APHID. In 1935, Ernest Dusaugey published Souvenirs héroïques de l'électricité au pays de la Houille Blanche, Grenoble, Librairie Dauphinoise. He also developed his philosophical ideas in an unpublished document, Voyage aux pays de la science et du mystère.

11. 352 ha of private property, bought by the Compagnie Bonne et Drac, were flooded. Dusaugey, 1943.

12. La Dépêche Dauphinoise, 19 juin 1935, cité par Obled (1998).

13. Le Petit Dauphinois, 11 mai 1936, cité par Obled (1998).

ABSTRACTS

The heated discussions and controversies over large dams that marked the start of the 21st century have led us in this article to examine the conditions under which Alpine dams were received during the first construction phase of the 1920s and 1930s. Although the extent of social and environ-mental impacts was not the same, the types of questions raised concerning methods of appropriation and uses to which water was put are similar. Among the arguments for and against, which always tend to be structured around the promotion or denunciation of the virtues of modernisation and development, the acceptability of dams depends firstly on the disturbances caused to the distribution of property rights and land usage rights and the ability to balance out gains and losses among the different social groups concerned. These questions are examined in the light of two dams constructed in the French Alps in the 1930s, the Chambon and Sautet dams.

La vigueur de la « controverse des grands barrages » du début des années 2000 nous amène à nous interroger, dans cet article, sur les conditions de l'accueil fait aux barrages alpins lors de leur première phase de construction dans les années 1920 et 1930. Si l'ampleur des impacts, sociaux et environnementaux est différente, la nature des questions posées concernant les modes d'appropriation et d'usage de l'eau demeure. Au-delà des discours justificateurs ou accusateurs, structurés de façon pérenne autour de la promotion ou de la dénonciation des vertus de la modernisation et du développement, l'acceptabilité des barrages dépend d'abord des perturbations introduites dans la répartition des droits de propriétés et d'usages du territoire et de la capacité à compenser gains et pertes entre les groupes sociaux concernés. Ces questions sont travaillées à partir de deux cas de construction dans les Alpes françaises durant les années 1930, ceux du barrage du Chambon et du Sautet.

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